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Department of
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**Forest
Service**

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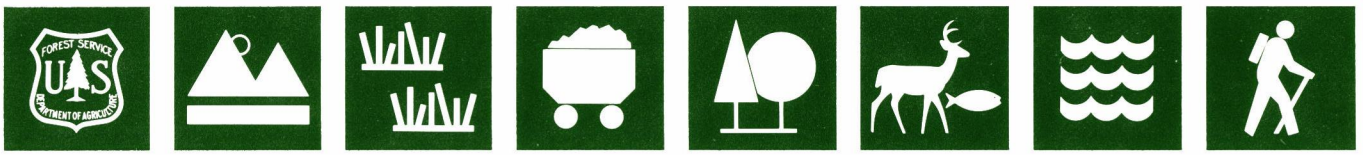
May 1989

Resources Planning Act 1989 Assessment

Fact Kit

This fact kit is designed so that a complete reading will provide you with a comprehensive understanding of the findings of the 1989 RPA Assessment. Reading just the Introduction and the opening summeries of the fact sheets for each resource will provide you with a quick overview.



Introduction

Highlights of the 1989 RPA Assessment

Wise resource management is a long-term undertaking requiring periodic reevaluation of current conditions and projected future needs. The periodic assessment called for by the Resource Planning Act of 1974 (RPA) provides an opportunity for such an overview. The RPA directed the Secretary of Agriculture to prepare a Renewable Resources Assessment in 1975 and 1979, and an update every 10 years thereafter. The Assessment includes "an analysis of the present and anticipated uses, demand for, and supply of the renewable resources of forest, range, and other associated lands with consideration of the international resource situation..." for both public and private lands.

The 1989 Assessment comprises a Summary Assessment (which is an overview of the land base, outdoor recreation and wilderness, wildlife and fish, timber, forest and range land grazing, water, and minerals) and separate Assessments for each of these resources areas. Readers wanting detailed information on these resources should consult the supporting documents.

The information in this fact kit is drawn from the 1989 Assessment. Although necessarily abbreviated, the kit contains key facts that will help readers understand the Nation's renewable resource situation. The Assessment serves as a basis for the development of the RPA Program.

The RPA Program for the National Forest System, State and Private Forestry, and Research must respond to this projected future for renewable resources, demonstrating the role of the Forest Service in providing natural resources for the Nation.

Summary Findings of the RPA Assessment

- **Demands for most renewable resources are projected to continue to increase. Although the rates vary among resources, the upward trend reflects the projected increase in population and economic activity.**
- **Supplies for most renewable resources are also projected to increase.**
- **Though international trade is projected to increase moderately, the majority of demands for natural resources will continue to be met from domestic supplies.**
- **This Nation has an abundance of opportunities to increase resource supplies through changes in resource management.**
- **Although some opportunities to expand supply are costly, others require relatively small investments.**
- **The opportunities to expand supply have direct implications for public programs and private management actions.**

Basic Assumptions

To understand the supply and demand trends described in the 1989 RPA Assessment, it is helpful for the reader to be familiar with the major underlying assumptions for the resource areas. Population and economic activity are both central determinants of resource demands and are assumed to increase in the future similar to how they increased in the past.

Population

Population projections were made by the Bureau of the Census. Population is projected to grow from 239.3 million in 1985 to 274.9 million in 2000 and 333.4 million in 2040.

The geographic distribution of population has a strong influence on State and regional demands for many products. State projections prepared by the Department of Commerce are used as the basis for regional projections of the demands upon soil, water, forest, and range resources. In general, the most rapid growth is projected for the South and the Pacific Coast. Major population concentrations, however, will remain much as they are today in the north central region and in the regions along the Atlantic and Pacific Coasts.

The average age of the population is expected to increase in coming years. The number and proportion of people in the middle-age classes—those with the highest income levels and largest demands for goods and services—will increase.

Gross National Product

In the past 50 years, the U.S. economy has been buffeted by world war, recession, and other dislocations, but the GNP has still more than quadrupled. The general outlook is for continued growth and increasing affluence for the United States.

The GNP was $3.6 trillion in 1985 and is assumed to rise to $5.4 trillion in 2000 and to $15.6 trillion in 2040 (1982 dollars).

The U.S. economy is expected to continue to produce large quantities of goods. In turn, large supplies of energy, minerals, and other raw materials will be needed to produce those goods.

Implied in our assumptions about international trade is that changes in the world economy will continue much as they have in the past.

The purchasing power of the populace is assumed to rise from $10,620 per capita in 1985 to $13,920 in 2000 and to $28,790 in 2040 (1982 dollars).

Institutional and Technological Changes

In the past, institutional and technological changes have substantially influenced demands upon soil, water, forest, and range resources. It is assumed that this trend will continue, and will affect demands for and supplies of the various renewable resources. It is also assumed that the effects of these changes are likely to be similar to the effects of changes found in the historical trends. Where possible, assumptions have been made about future technologies and their effects.

Institutional changes that lead to reservation of forest and range lands for designated uses, such as wilderness, parks, and wildlife refuges, are specifically taken into account in the projections of forest and range land areas.

Energy Prices

Crude oil prices are expected to increase approximately 40 percent from 2000 to 2040. Prices were leveled at $50 on the assumption that conservation and use of substitute energy sources would increasingly become widespread as prices increase.

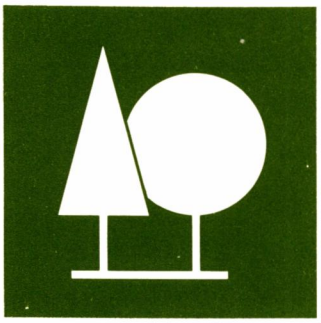
Red Meat Consumption

Assumptions about per capita consumption of red meat—beef, veal, lamb, and mutton—will greatly influence the need for rangeland, feed grains, and roughage. Annual per capita consumption of red meat has declined from 133.3 pounds in 1976 to about 110 pounds in recent years. Possible reasons for this downturn include changing tastes and preferences and relative prices of other food products. The 1989 RPA Assessment assumes that per capita consumption will remain near recent levels throughout the projection period.

Other Assumptions

In addition to the assumptions mentioned here, the demand and supply analyses included in the 1989 RPA Assessment rest on a variety of other specified and implied assumptions. These are addressed in the appropriate places of the Assessment and supporting technical reports.

Basic Assumptions



Timber

The area of timberland in the United States has been declining and will continue to do so, decreasing about 21 million acres by 2040. Total demands for both hardwoods and softwoods will increase significantly over the next five decades, especially for fiber-based products, such as pulp and structural panels. Harvests will increase, but real timber prices will be higher. There are many opportunities to increase supplies through improved utilization, greater harvest from the existing supply, and improved forest management. Taking advantage of many of these opportunities will involve increased investments in management, development of new technology, and assistance to private landowners.

Current Resource Situation

Private landowners control nearly three-quarters of the timberland (that is, forest lands capable of producing usable quantities of wood that are not withdrawn by statute or administrative regulation from timber harvest) in the United States. The Nation's timberlands contain 831 billion cubic feet of wood, of which 91 percent is growing stock and 9 percent is rotten or dead.

Growth nationwide exceeds the volume removed by timber harvesting, land clearing, and conversion to nonforest land use, but the growth/removals balance varies considerably by region. Growth nearly equals removals in the South and the Pacific Coast region. Growth is twice the removals in the Rocky Mountain region and more than twice the removals in the North.

Hardwoods are playing an increasingly important role in furnishing pulp.

The demand for firewood has fallen with the price of oil in the 1980's but will increase when oil prices rebound in the future.

Projected Demands and Supplies to 2040

Demand for softwoods will continue to climb, from 11.7 billion cubic feet today to 15.7 billion cubic feet in 2040. Demand for hardwoods will also rise, from 6.3 billion cubic feet today to 11.3 billion cubic feet in 2040. Demand for pulpwood will increase more quickly than for other products.

Imports, largely from Canada, now supply about 28 percent of our Nation's timber products, especially pulp, newsprint, and lumber. Exports of timber products have also been rising and net imports (imports minus exports) are expected to decrease from current levels of 2 billion to 1.6 billion cubic feet by 2040.

The outlook for timber supplies depends in part upon the outlook for the area of timberland. Timberland area has been declining in recent decades in the South and the Pacific Coast regions. The decrease in timberland area by 2040 is projected to be 21 million acres—some 4 percent of the total acreage of timberland.

Most of the increase in timber harvests will come from private lands. Harvests from public lands are projected to remain about where they are today, and allowable sale quantities on National Forest System lands are projected to follow forest plans. The South and Pacific Northwest will remain the principal regions producing sawtimber.

The current growth/removals balance shows that both hardwood and softwood forests can support additional harvests, especially if lands owned by forest industry are managed intensively. In the South, for example, timber from intensively managed plantations forms the basis for a 30-percent expansion in harvests by 2040. Prices for high-valued hardwoods are expected to increase in the immediate decades. Prices for softwood stumpage are projected to increase annually 1.14 percent in the Douglas-fir region and 1.03 percent in the South by 2040 (1982 dollars).

Effects

Increasing timber prices have positive effects on timberland management. In addition to stimulating improved stewardship, they motivate technological improvements in the processing industries. Rising prices also affect the way wood is used in housing and other end products.

Increased harvest levels will have impacts on nontimber forest resources. As prices of forest products rise, use of substitutes such as concrete, steel, aluminum, and plastic will increase.

Technological advances are expected to improve the efficiency of forest product utilization and the productivity of workers in the future as they have in the past. This will lead to a reduction in total employment in the forest industries despite significant increases in total output. Because many of the people employed in the forestry sector live in rural areas, declining employment will affect some rural economies.

The knowledge and technology needed to grow and harvest timber in an environmentally acceptable manner exists. If this knowledge is not applied, however, the quality of timberland and related resources, such as water and fisheries, can be adversely affected.

Opportunities

There are significant opportunities to expand timber supplies to respond to rising demands for timber. These opportunities can be grouped into the three following categories.

1. Timber supplies can be extended by:

- Increasing the useful life of wood products by preservative treatments, improving designs of new structures, and renovating and maintaining existing structures rather than replacing them.
- Improving efficiency in harvesting, milling, construction, and manufacturing.
- Utilizing unused wood materials such as logging residues; treetops and limbs; rotten and dead trees; trees in urban areas, fencerows, and low-productivity forest areas; and urban wood wastes.
- Increasing the recycling of paper and paperboard.

2. Harvests from the existing timber resource can be increased by:

- Increasing softwood and hardwood timber harvest on eastern timberlands.
- Accelerating harvests on National Forests in Washington, Oregon, northern California, northern Idaho, and western Montana that have large quantities of old-growth softwood timber.

3. Annual timber growth can be increased by:

- Planting trees, harvesting mature stands of trees and replanting, and converting existing stands to more desired species.
- Applying intensive timber management practices such as regulating species and spacing, fertilization, and use of genetically improved trees.
- Using management and harvesting practices to prevent or reduce losses caused by natural mortality, weeds, wildfire, insects, diseases, and poor logging practices.

The greatest opportunities for increasing supplies lie in intensified management of nonindustrial private lands.

Challenges to Improving Timber Management

Nonindustrial private timberland owners often have limited knowledge of management opportunities. They also vary in their willingness to make investments that could increase timber growth and the utilization of timber. The majority of the additional timber growing opportunities exist on the nonindustrial private forest lands.

On lands managed for multiple uses, lack of market prices for resources such as wildlife and fish make it difficult to manage timber in a way that gives appropriate weight to these other resources.

Implications for Timber Management

Improved utilization could extend existing timber supplies, especially in the short run, and increased growth provides a practical means of meeting demands in the long run. Timber management assistance and research directed at regenerating stands to desirable species and reducing the timelag between harvest and regeneration have the biggest potential for increasing growth.

Changes in technology that permit the use of hardwood species in the manufacture of pulp and structural panels offer opportunities for increased harvest of hardwoods. Management of hardwoods has traditionally been oriented toward solid wood products. These new markets for fiber have implications for how the hardwood resource is managed.

The increased future reliance upon private lands for timber supplies has many implications for informing landowners about timber management opportunities.

Lands

The United States has an abundance of forest and range resources—1.5 billion acres. Forested areas are projected to decline at a moderate rate to 2040, while rangelands will increase moderately. About two-thirds of the forest and range lands are in non-Federal ownership. Most Federal lands are administered by the Forest Service and Bureau of Land Management. Lands in the West are predominantly Federal; in the East, non-Federal. A high proportion of the non-Federal lands are producing well below their potential for renewable resources.

National Overview

About 63 percent of the United States, 1.5 billion acres, was in forest and range land in 1987.

- Most of the Nation's forest and range lands are in non-Federal ownership. In 1987, 67 percent of the total was owned by non-Federal public agencies, forest industry, farmers and ranchers, and other individuals. Non-Federal forest lands are concentrated in the East and private rangelands are concentrated in the West.
- Most of the Nation's highly productive forest lands are located west of the Cascade Mountains in the Pacific Northwest, and in the South.

The North and the Great Plains

In the North and Great Plains, 28 percent of the land is forested. Hardwoods are the dominant forest type in the North. The Great Plains have a fairly even mix of softwoods and hardwoods. Much of this forest land lies close to densely populated areas and receives intense pressure from a wide array of forest users.

About 80 percent of all timberland (that is, forest lands capable of producing usable quantities of wood that are not withdrawn by statute or administrative regulation from timber harvest) in the North and Great Plains is held by individuals or firms, although there is much variation among the States. Farmers own more forest land than any other group of individual owners.

A total of 78 million acres in the North and Great Plains is classified as rangeland. Almost all is in the Great Plains. Ninety-five percent of the rangeland is in non-Federal ownership.

Water areas in the North and Great Plains, mainly in the Great Lakes, total 57.9 million acres and cover about 9 percent of the area, representing 54 percent of the Nation's surface water.

The South

Forests cover 37 percent, nearly 200 million acres, of the total land area of the South.

The South's 62 million acres of pine forest continue as a major source of softwood fiber for the world. About two-thirds of the pine forest is natural in origin and the remainder is planted pine.

The acreage in the South is about balanced between hardwoods and softwoods. Oak-hickory is the South's most extensive ecosystem, covering 71 million acres. Bottomland hardwood types cover 31 million acres. The remaining types include spruce, fir, maple, beech, birch, and pinyon-juniper.

Nonindustrial private owners control 70 percent of the timberland in the South and forest industry owners control 20 percent.

The South has 116 million acres of rangeland, with 83 percent in Texas and most of the remainder in Oklahoma and Florida.

Water in the South covers 23 million acres, 4 percent of the area, and 6 percent of the total surface water area in the Nation.

The Rocky Mountains

More than 138 million acres, about 25 percent of the land area, are forested, predominantly by softwood species.

Pinyon-juniper is a woodland ecosystem covering about 47 million acres of dry plateaus and broken tablelands, about 35 percent of the total wooded acreage of the area. Pinyon-juniper is the predominant vegetation type in Arizona and New Mexico.

Three-fourths of the forest land in the Rocky Mountain region is publicly owned. Federal agencies, principally the Forest Service, administer 94 million acres, two-thirds of the total.

The total rangeland area includes forested lands that are used primarily for grazing. Pinyon-juniper and chaparral-mountain scrub forests cover about 336 million acres, 61 percent of the total land base. Other important rangeland types include sagebrush, southwestern shrubsteppe, desert shrub, mountain grasslands, mountain meadows, desert grasslands, and plains grasslands.

Fifty percent of the rangeland in the Rocky Mountain States is in public ownership, mostly in the care of the Bureau of Land Management.

The Rocky Mountain region has the smallest water area—roughly 5.8 million acres, or 1 percent of the total geographic area.

The Pacific Coast

Forests cover 220 million acres, 39 percent of the total land area of the Pacific Coast States. These forests make up 30 percent of all the forest land in the Nation. Productive timberland totals about 85 million acres and other forest land about 135 million acres.

Douglas-fir, the most important forest type in terms of timber production, covers about 21 million acres. It is the major type in western Oregon and western Washington. Fir-spruce, the most extensive forest type, covers about 116 million acres, mostly in Alaska's interior.

The pinyon-juniper type covers about 5 million acres, and chaparral covers about 7.6 million acres, mostly in the mediterranean climatic zone in California.

Of the 220 million acres of forest land in the Pacific Coast area, 33 percent is privately owned. Of the remainder, 32 percent is managed by the Forest Service and 68 percent by other public agencies.

Alaska has about 173 million acres of rangeland, most of which is arctic and alpine tundra. California, Oregon, and Washington together have about 68 million acres of rangeland.

The Pacific Coast States contain 20.2 million acres of water, much of which is in coastal waterways.

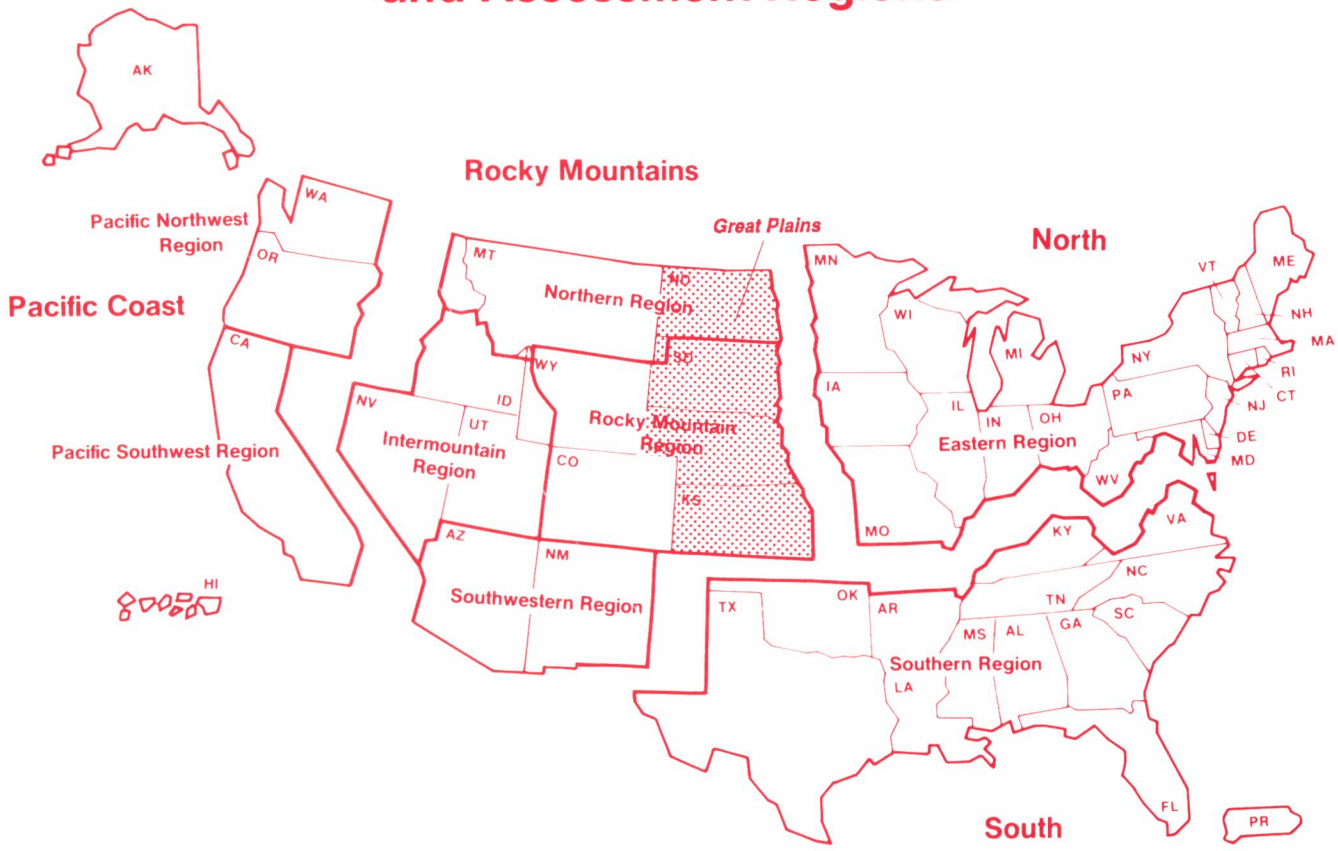
Projecting Land Use Changes

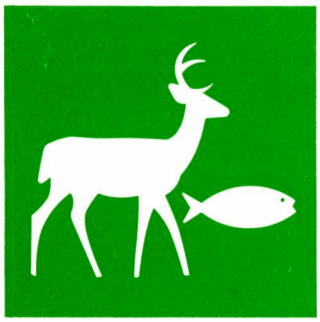
The combined total area of forest and range land is projected to increase about 2 percent between 1987 and 2000, largely because of the conversion from agricultural uses to rangeland. However, a projected 4-percent reduction in forest land area will result mainly from conversion to other land uses such as reservoirs, highways, and surface mining, and from urban expansion.

The projected average annual reduction in forest area in the United States from 1987 to 2040 (about 500,000 acres per year) is less than the average annual reduction from 1970 to 1987 (about 2 million acres per year).

In the North and Great Plains, forest and range area is projected to decline. In the Rocky Mountains, total forest and range area is expected to increase by about 15 million acres by 2040. In the Pacific Coast region, forest area is projected to decrease by 8 million acres and range area is expected to increase by 3 million acres. In the South, total forest area is expected to drop by 9 million acres by 2040.

Forest Service Regions and Assessment Regions





Wildlife and Fish

Demands for nonconsumptive wildlife use (birdwatching, photography, watching wildlife), fishing, and migratory bird hunting are expected to increase over the next five decades. Other types of hunting use will decline slowly over the same period. Free access to private lands is becoming more restricted. Charging a fee for hunting on private lands is expected to become more common in the future and will lead to increased pressure on public lands.

Current Resource Situation

The United States abounds in wildlife and fish. Forested lands, rangelands, and wetlands are important components of wildlife and fish habitats. Forest land area has declined as a result of conversion to agricultural and urban land uses. Forests of southern pines, bottomland hardwoods, aspen-birch, and elm-ash-cottonwood have declined significantly in area. Mature and old-growth softwood stands are becoming increasingly rare in the major timber-producing regions of the Pacific Northwest and the South.

Over recent decades, there have been minor declines in the area of rangeland. Two important issues are the loss and fragmentation of grassland habitats in the East and degradation of riparian habitats in the arid West.

Wetlands account for only 5 percent of the total land area in the contiguous United States. Wetland area has declined significantly over the past several decades.

About 80 percent of the Nation's flowing waters have some problems with water quantity, water quality, fish habitat, or fish numbers and species as a result of industrial, agricultural, forestry, and other human activities.

Farming in some areas has reduced much of the nesting, feeding, and winter wildlife cover, and resulted in increased erosion, which has degraded aquatic habitats in the affected areas.

Wildlife and Fish Population Trends

Changes in habitat are the major reason for trends in population changes.

Surveys of nongame birds indicate that 64 percent of the breeding bird populations have remained stable, with greater decline in the East than in the West. In general, populations of migratory game birds (except geese) have declined. Populations of breeding ducks have declined from 44 million in the early 1970's to about 30 million in the mid-1980's.

Populations of big game species have recently increased in all regions, except for deer in the Pacific Coast region. State wildlife and fish agencies are optimistic about future big game populations, with the expectation of stable or upward trends for all species.

Populations of small game species associated with agricultural lands have shown significant declines over the last 20 years, but populations of most small game species that inhabit forests have remained stable or increased. Small game populations associated with agricultural habitats indicate a continued decline. Populations of northern bobwhite are expected to decline; declines in populations of pheasant and rabbit will be countered in the short term as a result of the Conservation Reserve Program.

Population trends in furbearing animals have varied—the most commonly harvested species appear to have stable or increasing populations, while other species such as red fox and mink have shown declines in some regions.

As of December 1988, there are 330 animal species listed as being threatened or endangered; 166 of these have habitats on National Forest System lands.

Use Trends

Nonconsumptive uses, such as recreational wildlife viewing and photography, have increased at a substantially greater rate than hunting and trapping. The number of big game hunters has generally increased during the last 20 years, although at a declining rate. The number of small game and migratory game bird hunters has shown recent declines and may be a response to lower game populations, reduced access, and crowded hunting conditions.

The number of hunters participating in big game and small game hunting is expected to decline. The number of hunters who pay fees for hunting on private lands is expected to increase.

The number of trappers has recently declined in apparent response to declining prices, but may also be affected by public and legislative pressure to restrict this activity.

The numbers of both recreational and commercial fishers have consistently increased during the last 20 years. Participation in cold-water fishing and nonconsumptive activities such as photography or birdwatching is expected to more than double by 2040. These substantial increases imply more intensive use, which may degrade the quality of the recreational experience for some people. It may also create investment opportunities on private lands.

For fishing and hunting, the largest potential for demand not being met exists for cold-water fishing, followed by migratory bird hunting, warm-water fishing, big game hunting, and small game hunting.

Effects

Restrictions on commercial hunting and projected declines in recreational hunting could severely affect local economies that depend on these uses of wildlife and fish. State wildlife and fish agencies, whose funds are derived primarily from license fees and excise taxes on equipment, could also be negatively affected.

Declining numbers of wildlife and fish, or restricted opportunities to enjoy them, will not only adversely affect the lifestyles of certain segments of society, but will reduce or eliminate a recreational outlet for which few substitutes exist.

More intensive use of the wildlife and fish resource means that future recreation seekers may have to travel greater distances to find suitable sites or may have to pay access fees.

The growing pressures on wildlife and fish resources are likely to be especially significant for threatened and endangered species, and those species with the potential to become so. As species become rare, or ultimately extinct, there is a reduction in biological diversity, a diminishing of the Nation's natural heritage, and a forgoing of future options.

Opportunities

There are numerous opportunities to improve the wildlife and fish situation:

- Protect key habitats (including wetlands, native grasslands, old-growth forests, fish spawning areas, and critical habitat for threatened and endangered species) through public purchase, easement, leasing agreement, or establishment of natural areas.
- Increase the size, diversity, and distribution of key habitats to preserve the natural diversity of a given region.
- Restore degraded ecosystems through 1) direct management of vegetation and water or 2) removal or control of the factors causing the degradation.
- Manage wildlife populations within the capacities of their habitat.
- Introduce species into areas with suitable habitat.
- Increase fish hatchery production through improved propagation practices, increasing the capacity of existing facilities, and building new facilities.
- Increase access to private lands by promoting programs that would assist landowners in establishing wildlife- and fish-related businesses. Questions of owner's liability should be addressed.
- Increase land acquisition.
- Manage the use of the land to increase the amount of wildlife habitat available and to distribute use.
- Increase programs to educate the public about the objectives of wildlife and fish management.

Implications for Wildlife and Fish Management

Managers could improve their use of techniques to monitor public attitudes and values so that they can address the public's needs and wants.

Cooperation could improve among the many agencies that have responsibility for management of habitat, wildlife and fish populations, and hunting and fishing.

The objectives of wildlife and fish management could be integrated into the management of forest and rangelands.

Research could result in improved information on habitat, wildlife and fish populations, habitat-population relationships, and the value of wildlife and fish resources.

Outdoor Recreation and Wilderness

The number of people participating in outdoor recreation will increase in the future as population increases. People will recreate more often, but they will travel shorter distances. Growth in incomes will increase demands for more costly forms of recreation such as downhill skiing and boating. The growth in recreation opportunities varies across the United States. Private lands are becoming less accessible; for example, only 21 percent of them are now available for free use. This will place more pressure on public lands, especially those near population centers.

Current Resource Situation

Lands available for recreation and the willingness of landowners to provide recreation differ significantly across the Nation.

- State and local governments manage over 54 million acres of recreation lands; 55 percent of these lands are in the East.
- The Federal Government manages 690 million acres of recreation lands; 95 percent of these lands are in the West.
- Nonindustrial, privately owned, rural lands open for recreation are declining because of conversion to other uses and restrictions on access. Only about 21 percent of these lands are open (free to the public) for recreation.

The National Wilderness Preservation System contains 89 million acres of Federal lands open for recreation: 57 million acres are in Alaska and 32 million acres are in the lower 48 States. Of the total 89 million acres, 32 million are managed by the Forest Service, 27 million of which are in the lower 48 States. The rate of increase in wilderness recreation visits has been slowing in recent years to the point where it has leveled off or even declined in some areas. Recognition of the nonrecreational uses of wilderness, such as education, scientific study, habitat preservation, and ecosystem preservation, is increasing.

The National Wild and Scenic Rivers System comprises more than 7,000 miles of rivers and streams, of which more than 85 percent are in the West. Sixty thousand miles have been identified by States as significant and, of those, 6,000 miles have been designated as "State system wild and scenic rivers" and are thus managed and protected.

Nationally, about one-third of downhill ski areas are on National Forest System lands. In the West, the percentage is higher—83 percent in the Rocky Mountain region and 78 percent in the Pacific Coast region. Over 67 percent of the Nation's cross-country ski areas are located in the Northeast.

Federal agencies are actively encouraging private investment in and operation of sites, facilities, and services on public lands. These partnerships between the public and private sectors have stimulated a healthy expansion of opportunities on public lands.

Projected Demands and Supplies to 2040

The demand for recreation continues to rise, but the rapid rate of increase in outdoor recreation has slowed in recent years. At present, the rate of increase in the use of public recreation areas largely matches the rate of increase in population.

Extended long-distance vacations, especially by automobile, are being replaced by more frequent, close-to-home trips. Consequently, providing recreation opportunities close to population centers will become much more important in the future. Sites within 100 miles of major population centers will experience much heavier use.

Management, resource availability, access, and facility needs are projected to become more acute in the East than in the West. In the East, recreation opportunities near population centers are much more limited, crowding is greater, and private land closures have greater impact. Increasingly important limitations to outdoor recreation are lack of access to private lands and waters and of easements across private lands to reach public lands and waters.

Gaps between the demand for activities and the supply of available sites are much larger for land-based activities than for water-based activities. The largest shortages appear to be for dispersed activities such as day hiking, sightseeing, and backpacking because of the location of the population relative to the resource. Water-based activities with the largest projected shortages are swimming in pools and such nonmotorized lake and river activities as sailing, canoeing, and kayaking. The largest shortages of snow- and ice-based recreation are for dispersed activities, such as cross-country skiing.

Effects

In general, Americans who are city dwellers, elderly, less educated, economically disadvantaged, or disabled or belong to a racial minority have fewer opportunities to participate in resource-based recreation than do others.

Increased economic opportunities for the private sector are projected as sites are developed and associated goods and services are provided. Increased government revenue generated by user fees is expected to be offset by higher management costs for dispersed recreation.

Opportunities

There are opportunities to satisfy many recreation demands through:

- Improving public-private partnerships and interagency cooperation among public agencies at all levels.
- Improving efficiency in the management of recreation sites through improved maintenance and separation of uses.
- Improving the plans and designs of facilities to protect existing environments and resources.
- Providing types of recreation that match public demands and preferences.

Challenges to Improving Recreation Management

The principal obstacle to providing more recreation from Federal lands is the fact that appropriate lands are primarily located in the West and most of the population lives in the East.

The location of private lands relative to population will provide substantial opportunities for private recreation development.

Private landowners may be hesitant about opening their lands for public use, given the liability risks.

Public agencies need to cooperate and coordinate resource management activities at levels necessary to meet projected demands.

Implications for Recreation and Wilderness Management

Managers of public lands could manage recreation sites intensively, provide for resource interpretation for visitors, and conduct outreach programs to potential user groups.

Managers of public lands could also support access to both public and private lands and waters. Exchanges, easements, acquisition, and partnerships need to become more prevalent to provide for more access.

Maintaining the level of visual quality expected by users will be a significant management challenge. Quality, safety, and convenience will become increasingly important aspects of recreation management on public lands.

To provide recreation services to more segments of the public, recreation managers could expand and accelerate recreation and wilderness research programs. Particular research needs include improved techniques for handling more people at existing sites, for providing a broader array of sites and activities at reasonable costs, for monitoring wilderness uses and values, and for recreation planning and marketing.

Enhancing the opportunities for nonrecreational use of designated wildernesses and primitive areas could make a significant contribution toward the study of how ecosystems respond to outside influences, such as atmospheric deposition.

Range

Future total demands in the United States for red meat will increase along with the growth in population, because per capita consumption is expected to remain at near its current level. Forage supplies from public lands are expected to remain fairly constant. The productivity of private range will improve slowly over time. Demands and supplies will be in balance by 2040, with most of the increased supply coming from private lands. Multiple-use management of public rangelands is becoming more necessary to accommodate competition among domestic livestock, wildlife, recreation, and other uses.

Current Resource Situation

Between 1969 and 1982, total land available for grazing declined 8 percent. Both forest grazing and pasture and range grazing declined steadily. These long-term declines resulted from several forces in pasture and rangeland: 1) shifts in usage from grazing to croplands, particularly in the South, 2) withdrawal of public land for recreational, wildlife, and environmental purposes, particularly in the Western United States, and 3) withdrawal of land for urban areas across the Nation. Since 1969, 30 million acres of pasture and range land have been converted to other uses.

Generally, the rangeland managed by the Bureau of Land Management (BLM) and the Forest Service provides 7 percent of forage consumed by livestock. In certain areas, Federal rangelands are significant sources of forage. Livestock grazing on National Forest System lands has remained fairly constant since 1953, with only a slight decline, primarily in the number of sheep and goats. Livestock grazing on BLM lands has declined as a result of reductions in the number of animals allowed on some allotments and a transfer of BLM-administered lands to other agencies.

Meat Consumption

Total per capita consumption of meat increased slightly from 1965 to 1985. Per capita consumption of beef surpassed that of pork in 1953 and increased steadily to a peak in 1976, then declined.

Annual per capita consumption of lamb and mutton for 1985 was 1.1 pounds, compared with the total annual consumption of red meat–beef, veal, lamb, and mutton–of 110 pounds. Per capita consumption of red meat is assumed to remain about level through 2040.

Projected Demands and Supplies to 2040

Rangeland forage production on private lands is projected to grow at 0.7 percent per year. This growth is based on the assumption that productivity of rangeland will increase as currently available technology is implemented.

A slowly increasing demand for forage is the result of population growth and, to a lesser degree, per capita disposable income. By 2040, total demand for forage will have increased 54 percent over 1985 levels.

Effects

Livestock grazing will continue to contribute to the economies and lifestyles of rural communities. More opportunities are likely to exist for urban dwellers to experience the range resource through recreational activities.

Although the projected demand for grazing implies a continuation of livestock production, the projected change in distribution of forage implies a significant shift in livestock production. Most of the increase in forage production will be on private lands. Traditional practices of grazing on public lands for a portion of the year cannot be increased proportionate to the total increase in grazing. Thus, there will likely be some shifts in ranching practices.

Increased multiple use of rangeland will create opportunities for management of the rangeland resource. This may create opportunities in the private sector, such as leasing land for recreation.

Opportunities

Opportunities to improve vegetation on the range include instituting grazing systems that allow time for the vegetation to recover between times of use, managing streams for riparian enhancement, expanding the variety of plant species in an area to lengthen the seasonal availability of forage, and using biological control agents, including livestock, on noxious weeds. In addition, management of the many species of grazers and browsers can increase the efficient use of range and forest vegetation.

Implications for Range Management

Successfully managed rangeland contains healthy vegetation that protects soil and water. Management of riparian and upland habitat for fish and wildlife is becoming more important.

Range management practices could be shifted so that livestock use becomes a tool for improving vegetation and promoting ecological diversity.

The integration of wildlife and fish management considerations into comprehensive land management plans will become increasingly important.

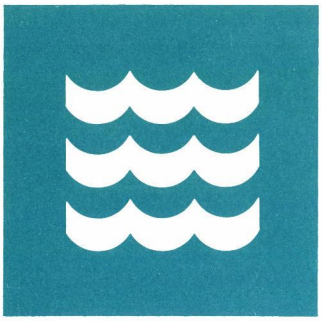
Urbanization in areas near the National Forests, and the expansion of recreational use in the National Forests, result in competition for use of public forests and range lands. Increased coordination among resource managers would help maintain a balance between these competing interests.

Management opportunities which may be addressed through additional research include:

- Determining and quantifying how vegetation can be managed to produce many resources from rangelands.
- Determining and quantifying how to use various grazing species in the management of rangelands.
- Defining opportunities for using livestock to manage the vegetation in more ecosystems.
- Developing methods to analyze the consequences of increasing demand from rangelands.
- Quantifying and monitoring local and regional impacts of managing many resources across many ownerships.

Much of the increase needed to meet future demands for grazing is projected to come from private lands.

Technical assistance could facilitate more intensive management of these lands.



Water

The United States has an abundant water supply. Shortages occur because supply is distributed differently than demand. Most of these shortages are in the West and most directly affect irrigation as water supplies are reallocated when water rights are sold. Water quality is becoming a bigger issue. Nonpoint sources of pollution are receiving more attention as pollution from point sources is lessened. Although a fairly high percentage of the Nation's waters are now fishable and swimmable, about 80 percent have opportunities for improvement of the fish habitat or the composition of the fish community. In general, many aspects of water quality have improved significantly over the last decade, and continued monitoring and enforcement of laws and regulations should bring about even more improvement.

Current Resource Situation

The United States has abundant supplies of fresh water. Daily consumption amounts to less than 7 percent of the renewable water supply.

The Nation's watersheds are generally in good condition. However, special attention must be given to managing the soil and vegetation on more than 70 percent of them to maintain or improve the quality and quantity of water flowing from them.

Ninety million acres of wetlands remain in the contiguous United States, less than half the acreage that existed 200 years ago. Wetland losses are continuing at an estimated 350,000 to 500,000 acres annually. The principal reason for the continued decline in wetlands is conversion to urban, suburban, and agricultural uses.

Concerns about water shortages in the United States arise because supplies and demand do not generally coincide. Water resource developments, such as reservoirs, have been the preferred way of increasing the availability of water, but future large-scale developments are unlikely due to the economic and environmental costs. Other methods of increasing water availability have been tried, such as modifying weather and recycling wastewater. Recycling has gained little popularity in the last decade.

A relative abundance of good-quality surface water still exists nationwide. However, serious problems have developed in the water quality of some regions. Acid rain, sedimentation, and groundwater contamination are three important water-related environmental problems.

Programs resulting from the 1972 Clean Water Act have made significant progress in cleaning up pollution from specific sites. Control of pollution from more generalized sources, such as agriculture, is gaining more attention from landowners and land managers. Monitoring studies have shown widespread increases in nitrate, chloride, arsenic, and cadmium levels.

Projected Demands and Supplies to 2040

Demand for water in the South and the Rocky Mountains has increased at twice the rate as in the North and the Pacific Coast States.

Water shortages are projected for the lower and upper Colorado River and the Rio Grande as well as the Great Basin and California by 2040. Irrigation is the predominant consumptive use in each of these regions where shortages occur. Water surpluses exist regionally east of the Great Plains and in the Pacific Northwest, even in dry years.

It can be expected that water quality in 2040 will be improved, because current pollution abatement efforts are just beginning to bear fruit. However, soil-disturbing activities will cause short-term negative impacts to specific rangeland and forest sites.

Effects

If recent patterns of water use and related land resource use do not change, there will be significant environmental, economic, and social consequences for American society. Some of these potential consequences will be:

- Reduction in some areas of fish and wildlife habitat and some recreation use.
- Increased salinity, affecting communities that rely upon surface water for potable supplies and farmers who depend on the water for irrigation.
- Declines in waterfowl populations and in fishing, hunting, and other recreational benefits in some areas.
- Expansion of urban and suburban areas at the expense of prime agricultural land and wetlands.
- Overuse of groundwater.
- Change in local economies, especially those relying heavily on irrigated crops and products made from them.

Opportunities

Many opportunities exist for changing watershed management practices on all ownerships to help avoid water shortages and improve water quality. Only through the coordinated efforts of all landowners—public and private—can water and related resources be used to reach their full potential.

The major opportunities to protect the water supply are through administrative controls and state water rights procedures. Other opportunities include: 1) maintaining water quality by managing vegetation; 2) managing the timing of runoff by using vegetation, snow-trapping structures, and weather modification; 3) improving riparian areas to keep pollutants out of streams and to provide cover for fish and wildlife; and 4) enhancing soil productivity by taking into account the chemical, biological, and physical characteristics of the soil.

Many opportunities exist to educate landowners about the importance of pollution abatement practices and how to apply them consistently.

Expected increases in crop yields, and wetland protection activities resulting from the Food Security Act of 1985, present opportunities to reverse the trend in loss of wetlands.

Challenges to Improving the Resource

Modifications in water rights and freer functioning of water markets could play a dominant role in solving water shortages. In some areas there is political resistance to unrestricted markets for water.

Priorities are often given to water uses that have adverse impacts on fish and wildlife habitat and recreation. Private landowners lack incentives to implement practices to reduce pollution, and income and property tax laws and regulations encourage the conversion of wetlands. Few incentives exist to encourage private landowners to manage wetlands for wildlife and recreation benefits.

Large-scale efforts to increase water supplies entail significant environmental risks.

Implications for Water Resources Management

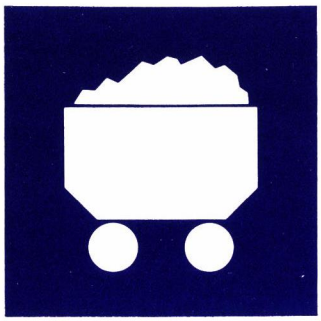
Maintaining and improving water quality should be a high priority for land managers. The challenge for forest and range land managers is to preserve the volume and quality of water, and thus promote fish and wildlife habitat and recreation, and also satisfy municipal needs in the next century.

Because municipalities prefer to pay for transporting clean water long distances rather than for cleansing nearby water to potable standards, municipalities may become vitally interested in land and water management issues.

Education, as well as technical and financial assistance, would encourage landowners to improve water quality, restore and protect riparian areas, and reduce flood damage.

Long-term collection of data is an important tool for studying complex ecological problems, such as acid deposition. Background information on how ecosystems function before the problems emerge could aid in determining true effects. Long-term monitoring could be established for this purpose.

More research could be done on maintenance of soil productivity. This involves predicting vegetation growth and possible timber harvest as a function of site characteristics. Data on nutritional needs of agricultural crops are available; similar kinds of information are needed for forest and range land species as well.



Minerals

Minerals are grouped into three categories: 1) energy minerals, 2) metallic minerals, and 3) industrial and mineral materials (for example, sand and gravel). Demand for energy minerals will increase, with prices depending on foreign competition, domestic production, and new technology. Demand for metallic minerals will also increase and will depend on technology development and evolution of end-use markets. Demand for industrial and mineral materials is likely to increase in proportion to population growth. Worldwide, there are adequate supplies of most minerals. There is little likelihood of a physical shortage of most minerals, but the price necessary to assure supplies may increase in the future, as is the case with petroleum. For some imported minerals, supplies will be influenced by the political stability of the producing country as well as the physical availability of the resource.

Current Resource Situation

The United States is rich in many of the minerals it requires. In 1986, the United States was among the top three producers worldwide for some 33 of 87 important minerals. Most of the U.S. coal reserves lie under forest lands in the Appalachian region and under rangelands in the northern Great Plains; most of the metallic minerals lie under forest and range lands in the Rocky Mountain region.

A substantial portion of the Nation's mineral resources is found on Federal lands, chiefly those administered by the Forest Service and the Bureau of Land Management. On National Forest System lands, the minerals most likely to be mined are coal, oil and gas, phosphate, molybdenum, and precious metals.

Projected Demands to 2040

Demand for energy minerals is expected to increase moderately, with a decrease in the use of oil and an increase in the use of coal.

Demand for individual metallic minerals is changeable, and varies with the mineral. There has been a general decrease in demand since 1970, in part because new technology has allowed a switch to cheaper, nonmetal substitutes. Increased demand is expected through 2040.

Although the United States is a mineral-rich nation, it imports significant quantities of some minerals, especially petroleum. The trend is toward increasing oil imports, although the United States has abundant supplies of coal that could substitute for foreign oil. Some experts say there are domestic supplies of oil that could be exploited if prices become favorable.

Projected Supplies to 2040

The United States possesses large quantities of metallic minerals, but many are not being developed because of inadequate current prices or high extraction costs.

Nationwide, large quantities of minerals materials are used in construction. There are abundant supplies of metallic minerals worldwide, but their cost and reliability of supply raise questions about their availability.

Although world supplies of oil are currently abundant, political factors could reduce the amount of foreign oil available for purchase by the United States.

The quantity of recoverable oil is uncertain over the long term, but the Nation has abundant reserves of coal, oil shale, tar sands, and uranium, and the potential for greater use of geothermal resources. Future policies regarding global climate change could have a significant effect on use of fossil fuels.

The market for many minerals is global in scope and extremely complex, and for some minerals there are frequent periods of shortages or surplus. Supplies of some of the minerals critical to the U.S. economy or national security are controlled by unstable or unfriendly governments or are vulnerable to disruption by regional conflict.

Projected Supply/ Demand

Domestic consumption of minerals of all kinds is projected to increase. The United States has sufficient supplies of many of the minerals it requires, although it will continue to rely on foreign sources for some minerals of economic and strategic importance.

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Conflicts exist between minerals development and some social, economic, and environmental objectives.

Cost and perceived inconvenience discourage efficient use, consumer conservation, and recycling of minerals to extend supplies.

Implications for Minerals

There are opportunities to increase the production of the minerals beneath the Nation's forest and range lands, but their extraction must be compatible with other uses, and environmental quality must be maintained.

Although private lands provide many opportunities for development of the mineral resource, there is also expected to be increased interest in production on Federal lands, including the National Forest System.